The Northwestern MILLER

MILLING PRODUCTION SECTION

Pneumatic Conveying for Drying Flour

METHOD EXCITES INTEREST BECAUSE OF SAFETY, SIMPLICITY, EFFICIENCY

By John Fischer
Sprout, Waldron & Co., Inc.

THE use of pneumatic conveying methods for the drying of flour is exciting a great deal of interest because of its safety, simplicity and efficiency. In spite of the tremendous advances in the technic of pneumatic handling, however, experience and experiment still play a big part. The purpose of this article is to review the basic advantages and disadvantages of the current method.

A unit very frequently considered for the drying of flour is the negative pressure pneumatic system, in which the air used to convey the material is drawn into the system across a heating coil of some type. This coil can be gas fired, steam heated or electrically heated. The latter two methods are favored because the use of an open flame is generally taboo in flour mills. The flour itself is fed into the system through an airlock so that the amount of outside air drawn in with the flour is kept to a minimum.

There are many advantages to the use of a negative pressure pneumatic system, not the least of which are its simplicity, freedom from maintenance (the only points requiring any attention at all are the fan motor bearings and the airlock bearings), cleanliness (all leaks are inward, since it is a vacuum system), ease of installation and safety. The negative pressure pneumatic system will convey as well as dry, thus accomplishing these two important functions simultaneously.

The major drawback of a negative pressure pneumatic system is its relatively limited capacity as a flour dryer. For example, a system that is capable of conveying 40,000 to 50,000 lb. flour hr. can only effectively dry 6,000 to 8,000 lb. flour. Although this has not been a matter of major concern, since the majority of flour drying operations involve between 2,000 and 6,000 lb. hr., we have here an aspect of inefficiency which cannot be completely ignored.

Major Problem

One of the major problems is to determine the size of the flour drying system required. There are two approaches to this. The first is the quick way, or the rule of thumb. The second is the theoretical way. Although the latter seems to work out on paper, we have yet to see it prove out completely in a given installation. Such data as we have been able to check by the theoretical method, using assumptions as reasonable as we can make them, compare very poorly with results actually obtained. There are three reasons for this. In the first place, pneumatic dryers are not very efficient, as was pointed out a few moments ago. In the second place, many unknown factors exist, such as turbulence and eddy currents in the air stream. And thirdly, some of the assumptions which we are forced to make may not be right after all.

The rule of thumb method is based on the fact that approximately 1,000 BTU's are required to evaporate 1 lb. water. Let us suppose that we want to dry 3,000 lb flour hr. from 14% moisture content down to 10% moisture. This means that we must have a system capable of removing 120 lb. (.04 × 3,000) of water per hour. Since 1,000 BTU's are required to evaporate 1 lb. water, we will have to put 120,000 BTU's into the flour from the air stream each hour.

EDITOR'S NOTE: Mr. Fischer is chief product engineer of the materials handling division of Sprout-Waldron.

We know that we can supply air at 300° F. possibly even at 350° F. without harming the flour; and we also know from experience that if we do this, the flour will leave the stream at about 120° F. If we let X equal the pounds of air per hour, then the equation to derive the amount of air required is as follows: X × 0.24 (the specific heat of air) × [300°-120°]= 120,000 BTU's. With this equation we arrive at the amount of air and heat necessary in order to evaporate the water in the flour.

Solving the equation, we determine that X = 2,800 lb. air per hour or 46.66 lb. air per minute. Since air weighs .075 lb. cu. ft., this means that we will require 620 CFM. Experience indicates that the efficiency of these systems ranges from 35-66%. If we assume that our system will only be about 40% efficient, the air requirements jump to 1,550 CFM.

Our recommendations for a negative pressure pneumatic system to dry 3,000 lb. flour hr. from 14% moisture to 10% moisture would be to use an 8″ diameter conveying line and a 36″ diameter cyclone capable of handling 1,800 CFM of air. This would allow a comfortable margin to accommodate changes in ambient humidity and for adjustment of air temperatures.

Matter of Experience

One of the first questions you may ask, is how do we know that 300° to 350° will not harm the flour, and how do we know that the exit temperature will not exceed 120° F.? To be very frank with you, this too is purely a matter of experience and is based on observation and actual measurement of successful installations. Theoretically, in any flash drying operation, there should be very little rise in product temperature because most of the available heat input should be used for evaporation of moisture. Technical publications have indicated that flour can be heated to 140° to 150° F. without impairing its usability, but the resultant cooling necessary before putting it into storage would make this higher temperature uneconomical. By the same token, it is not too economical to heat the air above 350° F.

For those who are interested, here is how the theoretical method of computation works. To begin with we determine the pounds of water to be removed and the BTU's required. Using the example as cited above, we would have 120,000 BTU's per hour or 2,000 BTU's per minute. The next step is to determine the exit air temperature and permissible relative humidity at this temperature for equilibrium with flour at 10% moisture. Flour at a given moisture content can be exposed to air at a certain temperature and relative humidity without losing or gaining additional moisture. This information can be taken from graphs and tables which are available in various technical bulletins. In this particular case, where we are dealing with 120° F. as our exit air temperature, we find that a maximum relative humidity of 30% is indicated.

If the air enters the system at 80° F. and 80% relative humidity, it contains .018 lb. water per pound of air. At exit, 120° F. and 30% relative humidity, it will hold .022 lb. water per pound of air. Hence, the air can absorb :022-.018 or .004 lb. water per pound. Since we wish to remove 2 lb. water per minute, we need 500 lb. air per minute.

The theory breaks down a little here. The result above would indicate that a system using 6,600 CFM is required. This would require a 14″ diameter conveying line. Our experience has shown that a system this large is definitely not needed. Actually, the air leaving should be about 60% relative humidity at 120° F., and probably will be. Since the air and flour are in contact so briefly, we are inclined to somewhat discount the theory of basing the calculation on the equilibrium humidity at discharge. However, it is remarkable to see how much better the theory works when an exit temperature of 150° F. is used.

In calculating the heat losses or the heat input required for the theoretical system, the BTU's per minute for evaporation, sensible heat increase (to raise the flour from inlet temperature to final discharge temperature —the flour is assumed to leave at the same temperature the air does) and the heat losses, estimated or calculated through duct walls, are all added together, and from their sum the required inlet air temperatures can be determined. If T is the desired air temperature, then (T — 120° F.) × (500 lb. per minute of air) × (.024) equal the sum of BTU's above.

Summation

In summation, it should be worth remembering the following:

1. The rule of thumb method has been fairly adequate for sizing systems and is actually much more accurate than it appears to be.

2. The drying is a flash drying operation and probably takes place in the first 20 feet of the system. After that, long conveying distances will probably result in a trend toward equilibrium moisture conditions due to the retention time involved. Hence, best results seem to be obtained if the system is not over 50 to 75 ft. long. In the drying of semolina or farina, the flash effect would be less, and retention time would be more important, because of the effect of particle size.

3. Two stage systems in which part of the desired drying is accomplished in each system are effective

(Turn to CONVEYING, page 4a)

This is the time of year when we all like to relax a little, to greet old friends and new, near and far . . . It is the season of good fellowship and we would like to extend the Season's greetings to millers everywhere with a wish that we may all look forward to a year of peace and prosperity.

Small, Two-Man Automatic Flour Mill Developed in Hungary; Russia Places Order for 100

HUNGARY is to export 100 small automatic flour mills—said to be the first of their type in the world—to Russia. Mass production of the mill will be developed during the next three years, according to the Hungarian News and Information Service.

The prototype of the mill, which employs different equipment and processing methods from similar models made in other countries, was completed early this year, the service said.

The mill, which has a capacity of 20 tons, basis 24 hours, is mounted on a steel frame and is 16 ft. wide, 39 ft. long, and 22 ft. high. Fully pneumatic handling of the wheat is performed by high pressure fans arranged in the wheat cleaning section and the roller mill. Perfect cleaning of the wheat is insured by the well-balanced setting of the individual machine units.

The mill incorporates a wheat washer to facilitate cleaning. Equipment of the cleaning section is suitable for performing the attrition work of a well-equipped commercial flour mill.

The roller mill consists of 12 stages and the adoption of the latest grinding techniques makes it possible to produce the same grades of flour as commercial mills, it is claimed.

The mill can produce patent flour, first-class flour, and high-quality bread flour. It is also possible to produce different varieties of any of these three grades, complying with standing requirements (according to touch, color and ash content). This is insured by means of an integral threefold flour-worm.

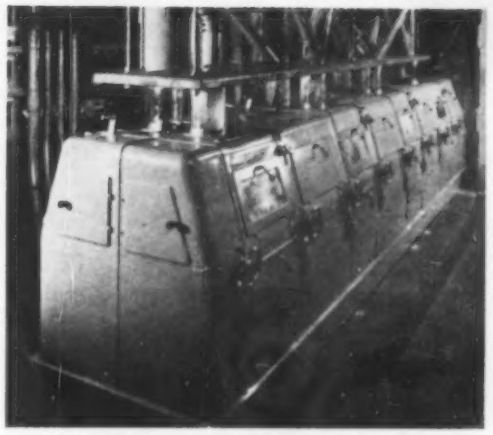
The roller mill consists of 12 pairs of rolls—four breaks; four grinders; two corundum reducers; two bran finishers.

Crushing and grinding are performed in a roller block, differing in performance from former individual roller mills inasmuch as factors affecting perfect grinding have been eliminated. Gear wheels have been dispensed with and the rolls are coupled through flexible clutches.

Bolting is done with a large double-box sifter. Grits and middlings are cleaned in a grit cleaning block of novel design.

Though the whole equipment of the mill is assembled in a single block, it is so designed that demands for all kinds of flour grades can be satisfied. This is made possible by the ample facilities for grading the middlings and the finished products.

The units of the equipment have been grouped in such a manner that they can be electrically driven either separately or in groups. This arrangement achieves low power consumption, it is claimed. The milling equipment is assembled of standard parts. The electrical equipment controlling the running of the whole mill is controlled from a switchboard.



A section of two-man Hungarian mill.

Emergency press buttons arranged at different spots insure immediate stopping of the whole equipment in case of accidents or faults.

Features of the equipment are easy transportability, quick assembly, and the exceptionally small floor space required (13 yards by 5½ yards).

The frame-mounted mill is dust-proof and needs only two operators, the report says.

This new product, it is claimed, is of special importance in smaller communities, since its output is sufficient to supply flour to a community of 25-30,000 inhabitants.

GUARDING AGAINST AIRBORNE DANGER

By Dr. W. Schweisheimer

THE Detroit Bureau of Industrial Hygiene received an urgent call for assistance from a flour milling company to determine the "dangerous gas" that was causing illness and unconsciousness in workers going into a grain storage bin.

G. M. Hama, industrial hygiene engineer with the Detroit bureau, investigated the complaint and he gave the following description of his findings. He stated that a worker descending into the feed "midds." storage bin with an all-purpose canister respirator experienced considerable discomfort and difficulty in breathing within the bin. With the assistance of other workers, the worker managed to get out. He was nearly unconscious when he was pulled out of the top of the bin.

A second worker descended with a safety rope and an oxygen-supplied breathing apparatus. When he reached the bottom of the bin, he signaled that he was in distress. He was unconscious when he was removed from the bin.

Results of Investigation

An inspection of the storage bin revealed that it was 8 ft. by 8 ft. and 30 ft. deep. The bin was about one third filled with feed midds., a coarse by-product of wheat used as hog feed. Access to the bin was through a small trap door on the top.

Several possible reasons were suggested as to the cause of discomfort and unconsciousness in the workers. The possibility of hydrogen cyanide gas from calcium cyanide fumigation was considered. Other possibilities were low oxygen and high carbon dioxide resulting from the oxidation of the grain in a confined space and hydrogen sulfide gas from grain decomposition. Tests showed that no hydrogen sulfide was present.

However, a test with a Wolf flame lamp, oxygen-determining apparatus, indicated that the oxygen content was considerably reduced. This was confirmed by chemical test methods. The low oxygen content could well be the cause of distress in the workers. Carbon monoxide tests were negative, and no hydrogen cyanide gas or cyanides were found to be present.

A recheck on the use of the oxygen-supplied respirator by the employees indicated the possibility of improper use of the equipment in not turning on sufficient oxygen. The hazard from this operation was corrected by Mr. Hama by ventilating the bin with duct-work and a compressed air ejector, which supplied a large volume of air to the bottom of the bin.

The compressed air ejector was preferred over the centrifugal fan because of the difficulty in obtaining a nonsparking fan blade and a vapor-proof motor which would be required because of the danger of explosion from grain dust.

Grain Handling Troubles

It seems that men working with grain are much more inclined to troubles of lungs and bronchi than other people. The Division of Industrial Hygiene, New York State Department of Labor, was requested some time ago by the Grain Handlers Union to appraise the health hazards which are connected with handling grain.

The investigation was carried out in the Buffalo area. According to a report by Drs. A. R. Smith, L. Greenburg and W. Siegal, the grain elevators of the Erie Basin region, some associated with flour mills, some independent, are capable of storing 40 million bushels of grain. The process of grain "scooping" consists in transferring the grain from the grain-carrying boats to grain elevators. Grain is threshed and rough cleaned at the point of production, then cleaned again by screening at the terminals.

The study of grain handlers in that area, as carried out by Dr. Smith and co-investigators, showed many more upper respiratory infections among these men. Why is that so?

First, there is the exposure to grain dust. The dust irritates the lungs and bronchi, particularly when workers are sensitive to irritation. Then there is exposure to the weather. Not all of the work is done during summer. In spring and fall there is nothing to temper the cold winds blowing over Lake Erie. The men who are waiting around the docks or on the boats till time to get into the hold, often become chilled and damp. The grain elevators, too, can be cold and drafty places.

Dr. Smith said that the fairly common use of alcohol "to cut the dust" increases the inclination to pneumonia. Another ailment, which results from exposure to the dust of screenings, is conjunctivitis, inflammation of the mucous membranes in the eyes. This is caused by mechanical irritation from the fine hairs of cereal hulls.

Almost a third of grain handlers at some time showed a condition spoken of as grain fever. Dr. Smith said about 2 or 3 hours after quitting work the workmen would notice general uneasiness, aches and pains as though getting the grippe, with chilly or feverish sensations. They would go to bed, frequently after treatment with liquor, and in the morning the signs would have disappeared. The picture is similar to the so-called "metal fume fever." It might be a reaction of the body to a body-foreign protein, which is contained in the grain.

Use of Respirators

Drs. Smith, Greenburg and Siegal recommend that approved respirators should be applied to such men as suffer from grain fever, breathing difficulties from handling grain, asthma or other ill effects from grain dust. Screenings should not be unloaded by the usual method, but by a vacuum system.

The grain handlers described various ways in which grain fever would appear. In some workers it started when they first began to work, and did not come again. In others it occurred at the beginning of each season or whenever they had been away from work for three or four weeks. In others it occurred at any time when the dust concentration was severe or when certain grains were being handled.

Wheat was most often mentioned as responsible for the unpleasant

(Turn to **RESPIRATOR**, page 18a)

COSBY-HODGES SAFETY FLEET — Photographed at their monthly safety meeting are drivers and their "co-pilots" from Cosby-Hodges Milling Co., Birmingham, Ala. In a total of 601,863 miles covered from October, 1957, to October, 1958, 19 of the 22 senior drivers had perfect safety records.

Safety Plans Pay Off In Fewer Accidents For Alabama Firm

BIRMINGHAM, ALA.—The result of a driver-safety program at Cosby-Hodges Milling Co. in Birmingham, Ala., has been cited to show the effectiveness of planning and follow-through in such a program.

Any company with a fleet of delivery trucks, it is noted, can profit from Cosby-Hodges' experience — their methods reduced road accidents from 11 driver-responsible collisions in 1953, to 3 accidents in 1958, all of which were listed as "unavoidable" by Alabama State Highway Patrol investigators.

Directed by Grady K. Burks, superintendent of Cosby-Hodges' shipping facilities, the program was started in October, 1953, and features a safety award plan with monthly cash bonuses on a cumulative basis for six-year periods. A driver with a perfect safety record for 12 months receives the 12 monthly bonuses, and another full year's perfect record doubles the yearly bonus, on up to a total of $60 for the current year 1958.

As an indication of the plan's workability, 19 of the company's 22 drivers had a perfect year in 1958, with eight of these men earning a perfect safe-driving record for the whole five-year span from 1953 to 1958. These records are considered even more impressive when fleet mileage records disclose a total of 601,863 miles driven, in 1958 alone.

Cash incentive is not the only feature of the safety program, however. An almost tangible "team spirit," it is said, insures more enthusiastic cooperation from employees than many an organization can expect for such a plan. Mr. Burks conducts regular monthly safety meetings with all the drivers and helpers, and he gives great credit to the Alabama State Highway Patrol and the Birmingham Police Department safety director. Both have had officers represented at the safety meetings, several times during the year, and they have encouraged the mill's program, educating the drivers toward top safety performance.

Each Cosby-Hodges driver sees the words "Courtesy is Contagious" on a windshield sticker in his truck. All credit for courteous behavior cannot, of course, be attributed to a windshield sticker, but it is true that the mill constantly receives calls and correspondence mentioning the unusual courtesy of Cosby-Hodges drivers.

——BREAD IS THE STAFF OF LIFE——

Manager, Technical Director Named By Panogen

William J. Crist

Dr. R. P. Seven

RAYMOND, ILL. — Petrus Hellman, president and general manager of the Panogen Co., Ringwood, a division of the Morton Chemical Co., has announced that, as of September, 1958, Panogen products have been distributed in Canada by Panogen of Canada, Ltd., 345 Higgins Ave., Winnipeg, Man. The new company is a wholly owned subsidiary of Morton Chemical Co., Chicago.

William J. Crist has been appointed manager, Canadian sales. He will be assisted by two field representatives, Lionel Hart of Winnipeg and James Taylor of Lethbridge, Alta. As manager of Canadian sales, Mr. Crist will be concerned with the distribution of Panogen and Drinox liquid seed treatments, Larvacide fumigants, and other products and seed treating equipment manufactured by Panogen.

Mr. Crist was graduated from the University of Minnesota in 1949, and joined Panogen as its first salesman in February, 1953. He has worked in various sales capacities in the U.S. and Canada. He has extensive experience in the agricultural field, having sold agricultural products for several years with a previous company. He also owns and takes an active part in the operation of a farm in Minnesota. Mr. and Mrs. Crist have temporarily made their home in McHenry, Ill., not far from the Ringwood chemical plant, headquarters for Panogen. Mr. Crist will divide his time between field work in Canada and duties in Ringwood.

Mr. Hellman also announced that Dr. Raymond P. Seven, former director of agricultural research at the Morton Chemical Research Laboratory, Woodstock, Ill., has been appointed technical director for Panogen. In his new capacity, Dr. Seven will be part of the sales management, devoting all his time to supervision of product development and field use.

CONVEYING

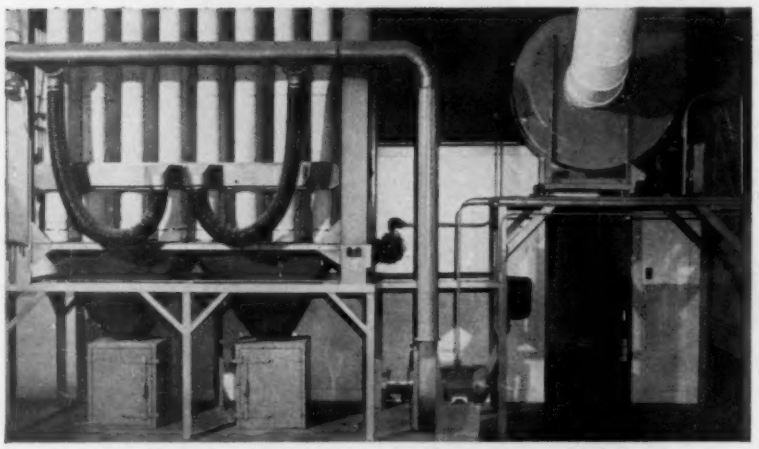
(Continued from page 1a)

when a greater degree of moisture removal is desired. If you want to take flour described above in the example to 6% moisture content, a second stage would certainly be indicated, rather than a larger system. It would be more efficient and its increased efficiency would offset its slightly greater initial cost.

4. It is our opinion that at some point, approximately 6%, the removal of additional moisture becomes a more complex problem, requiring higher product exit temperatures or possibly the preconditioning of input air. Experimental curves indicate that in this region, time becomes an increasingly significant factor.

It should never be forgotten, as was stated originally, that although pneumatic conveying systems are designed, and built by trained engineers, the drying of flour is still as much of an art as a science, and there is no substitute for experience. It is wise to consider each new problem and each new application as a special case.

DAY
DUST CONTROL NEWS



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Reports from Wheat Research Conference . . .

Separation of Proteins In Wheat Gluten

J. H. WOYCHIK
U.S. Department of Agriculture
Peoria, Ill.

In order that a more definite study of the structure and properties of wheat gluten can be made, it is first necessary to obtain a method whereby the gluten complex can be resolved into fractions more distinct than those obtained by the classical fractionation into glutenin and gliadin. Through the use of an aluminum lactate buffer system, Jones, Taylor and Senti have shown gluten to yield four electrophoretic components. Studies on the separation of gluten into fractions corresponding to those electrophoretic components are reported in the present paper.

The gluten proteins were readily adsorbed from solution in dilute acetic acid by carboxymethylcellulose (CMC). Attempts to desorb the gluten proteins by elution at increasing pH values or ionic strengths failed because of precipitation of the proteins in the column. Successful desorption was accomplished, however, by gradient elution with increasing hydrogen ion concentrations. While the optical density curves (280 mμ) showed no appreciable resolution of the proteins into chromatographic peaks, the proteins were eluted in the order of increasing electrophoretic mobilities. Displacement with stepwise rather than continuous increases of hydrogen ion concentration resolved the proteins into fractions, each consisting primarily of a single electrophoretic component. Rechromatography further separated the gluten proteins into reproducible fractions of high purity. In this manner, four fractions were obtained which corresponded to the electrophoretic components exhibited by gluten in the aluminum lactate buffer system.

The availability of wheat gluten fractions corresponding to observed electrophoretic components presents the opportunity for a more definitive study of these proteins. Further study of these fractions will include amino acid composition, sedimentation analysis, viscosity determinations, and other studies which will contribute to our knowledge of wheat gluten, thereby permitting further utilization of this unique protein.

EDITOR'S NOTE: Here are presentations from the recent third annual wheat utilization research conference. The conference was sponsored by the Northern and Western Utilization Research and Development Divisions of the Agricultural Research Service, U.S. Department of Agriculture. The conference, which was attended by about 100 persons, was held at the Northern Division headquarters in Peoria, Ill.

Current Developments In Milling Industry

STEPHEN J. LOSKA, JR., and R. K. DURHAM
The Pillsbury Co., Minneapolis, Minn.

The application of air classification techniques to wheat flours is the most outstanding current development in the wheat flour industry. It represents an extraordinary scientific break-through, the full potential of which has not been explored fully. The interest in this field is not limited to the remarkable products which can be made, for air classification also provides a new method of physically subdividing flour, from which technicians expect to gain greater knowledge of its properties.

Air classification provides an orderly, clear division of a number of flour parts which, despite some overlap of properties, broadens understanding of flour. A practical division of both hard and soft wheat flours is possible which produces fractions, alone or in combination, which have economic worth equal to the parent or source flour. In addition, the new techniques provide better utilization of wheats, whose true potential or latent quality are hidden by the limitations of old processes, so that these wheats may hold their rightful quality rank or position.

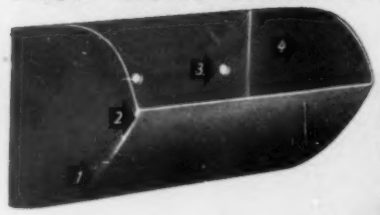
Separations can be made of hard wheat flour so that one fraction is enriched in protein matter, second and third fractions which are depleted of protein matter and lastly a fraction with enhanced bread baking properties by virtue of the removal of depleted protein fractions. Such separations can bake many forms and the number of separate flours depends upon how keenly one wishes to express distinctions. The four part separation according to flow dynamic size shown produces a small size fraction of high farinograph absorption, 78.7% in this case; two intermediate fractions of cake flour and pastry-cracker flour performance characteristics and a coarse endosperm chunk fraction. The coarsest fraction, endosperm chunk, can be blended with the high protein fraction to produce a superior bread flour; thereby taking advantage of the natural good baking properties of the fourth fraction and the strength and absorption augmentation of the fine high protein fraction.

The two flours of low protein, separated from the hard wheat flour, can be classed as cake and pastry-cracker flours because of their protein levels and their functional or performance characteristics. Chemical and physical test data clearly indicate that these two flours are distinct entities despite the difference of about 1.0% protein. Study of the analytical data illustrates oth-

E. L. Decker

FULLER APPOINTMENT — E. L. Decker has been appointed assistant chief engineer of the Fuller Co., Catasauqua, Pa. He was formerly supervisor of compressor engineering and in charge of fan development. A mechanical engineering graduate of Lehigh University, Mr. Decker came to Fuller in February, 1949, immediately after receiving his bachelor of science degree. He obtained a master of science degree in 1954 and in 1958 became a registered professional engineer in Pennsylvania. In his present post, Mr. Decker is replacing Robert E. Metzger, who has been appointed chief engineer of the Dracco division of Fuller in Cleveland.

First Choice Wherever Grain is Handled



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er properties which shift with the protein bearing material in this air classification example. Fat, high maltose value stock, high alpha amylase, lipase and protease activity material shift with the high protein fraction.

A separation of soft wheat flour is described such that a high protein fine fraction and two cake flour fractions were obtained. The high protein fine fraction contained 21.4% protein, in this case. A special purpose cake flour of 5.4% protein, which performs well in foam cakes and a secondary cake flour of 8.7% protein can be made. Blends of these two flours can be made which produce an 8.1% protein flour which when properly bleached shows extraordinary baking properties in high ratio cake formulas. Physical and chemical property differences are shown for these three fractions.

A very low protein content material with properties akin to wheat starch can be made in quantities to warrant consideration of this product as a food and industrial starch. Investigations are being made of the applications of this material and its potential economic worth.

Wheat Variety Quality Evaluation Studies

L. P. REITZ
U.S. Department of Agriculture
Beltsville, Md.

The crops research division conducts a national wheat research program of breeding, agronomic, disease and quality investigations. It operates four regional wheat quality laboratories. They are located at Pullman, Wash.; Manhattan, Kansas; Wooster, Ohio, and Beltsville, Md. The first three are cooperative with the respective state agricultural experiment stations and the fourth is cooperative with Agricultural Marketing Service. Each is closely associated with the wheat quality problems of the area it serves.

Work of the sort done in these laboratories is vital to the maintenance, stability and improvement of the quality of wheat grown in the U.S. This is so because wheat technology is not static. For instance, the dominant varieties grown on farms in 1958 were entirely different from those grown in 1954 in several large wheat areas.

The new durum varieties, Langdon and Ramsey, and the new hard spring varieties, Selkirk and Conley, occupied nearly all of the acreage this year in North Dakota. In the Palouse, Omar replaced almost all other club wheat varieties. Knox, Dual, Vermillion and LaPorte have taken over the acreage of soft red winter wheat in Indiana. Among hard red winters, Ponca has added materially to the quality of wheat in eastern Kansas, Oklahoma and Nebraska, and Bison, introduced just three years ago, has been multiplied as rapidly as seed stocks permit and is receiving acclaim both from farmers and millers in Kansas and Nebraska.

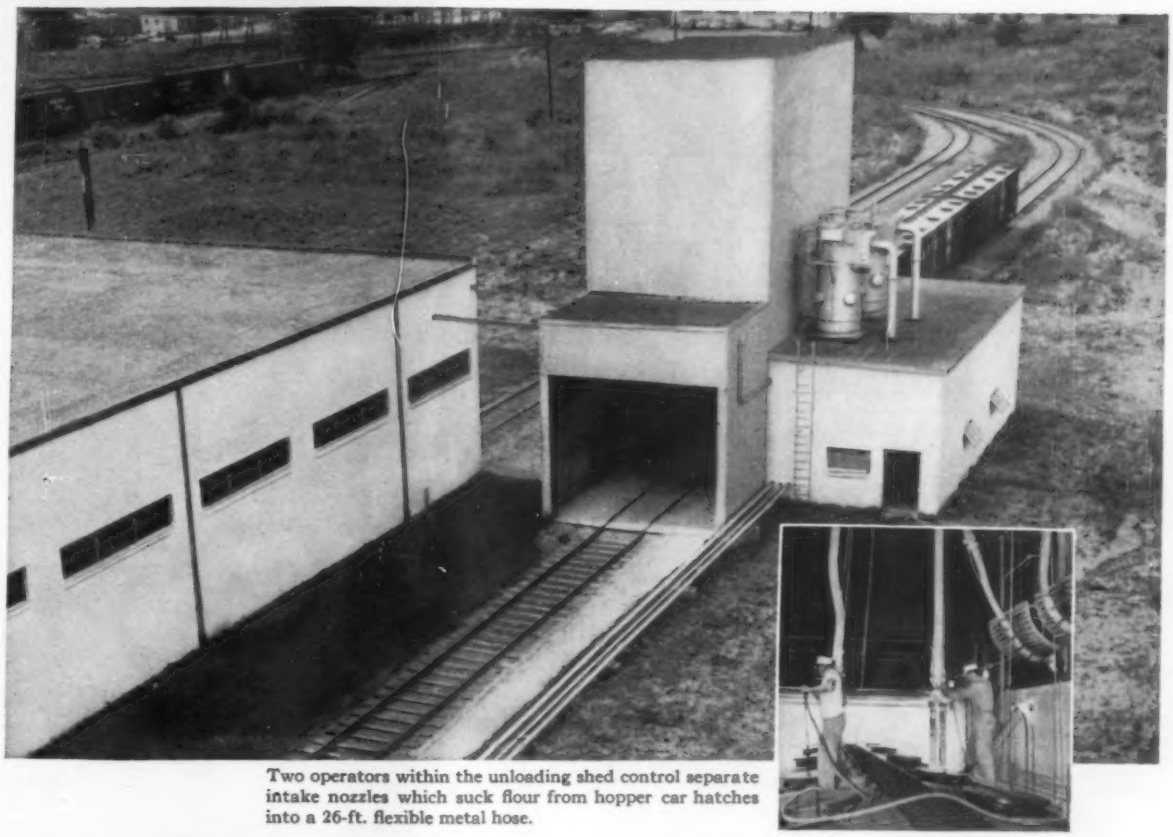
These changes were made without much, if any, disruption of traditional quality and indicate the importance and effectiveness of cooperation between the breeders and workers in the quality laboratories. Furthermore, the information gathered in these laboratories provided the principal facts for designating 33 varieties as unacceptable under the government's price support program with the result that the acreage of these undesirables has dwindled to practically nothing.

The four laboratories have both practical and basic research functions as follows: (1) To evaluate and characterize prospective new varieties before they are released to farmers, (2) to cooperate with wheat breeders in the development of high quality new varieties, (3) to determine in cooperation with agronomists, pathologists, chemists, entomologists, and others, the influence of management practices and of genetic factors on wheat quality, (4) to ascertain the basic chemical and physical nature of differences among varieties and classes of wheat in milling behavior, bread-, cookie-, cake-, and macaroni-making qualities, (5) to account for environmentally induced quality variability and devise methods to detect and to overcome such deficiencies, and (6) to design more accurate or precise, new or improved methods of measuring quality differences for more effective varietal characterization in plant breeding and genetic work.

Every year about 2,000 variety samples, submitted by plant breeders, are given full evaluation in the laboratories. In addition, an even larger number of samples is given single quality tests, micro tests for the most part. The thimble mill, for example, developed at Pullman, Wash., was used to evaluate 32,000 samples in the 1956 and 1957 seasons. As better tests are developed it is possible to mass evaluate populations developed by plant breeders.

General evaluation for quality has very little specific usefulness to plant breeders and almost none for geneticists. Therefore basic research to develop an understanding of each quality component is emphasized in the basic research done in these laboratories. Short cuts to quality deter-

The Arithmetic of Materials Handling



Two operators within the unloading shed control separate intake nozzles which suck flour from hopper car hatches into a 26-ft. flexible metal hose.

Flexibility of FULLER Pneumatic Conveying Systems Makes Problem Plant Site Practical For General Mills

The proposed site of a new General Mills flour blending and packaging plant in Louisville, Ky. seemed impractical to mill engineers because of the site's long, narrow shape. Flour, delivered at a dead-end rail siding, would have to be conveyed over unusually long distances—400 feet from unloading point to storage bins.

By incorporating Fuller Airveyor® pneumatic conveying systems in the plant design, General Mills has overcome these disadvantages and has completed one of the country's most modern bulk flour handling plants.

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mination are a by-product of this research.

Recent research in the laboratories has resulted in developments on methodology and on basic factors influencing quality including the following:

New five-gram milling-quality tests for use in wheat breeding.

Micro flour quality tests.

Estimation of protein in wheat and flour by ion-binding.

Interactions between proteins and polysaccharides of wheat flour.

The intrinsic viscosities of the water-soluble components of wheat flour.

Evaluation of flour fractions for their importance to cookie quality.

Cake and cookie flour fractions affected by chlorine bleaching.

A lean formula cake method for varietal evaluation.

Flour particle size and cookie quality.

Effects of the water-soluble constituents of wheat flour on cookie diameter.

Changes in cookie doughs upon heating.

Estimating starch tailings.

Effect on loaf volume of high temperatures during the fruiting period of wheat.

Effect of foliar spraying of Pawnee wheat with urea solutions on yield, protein content, and protein quality.

Quality characteristics of two pairs of isogenic lines of wheat.

Further developments in the sedimentation test for wheat quality.

Infrared spectra of wheat flour protein.

The relationship of types of phosphorus in wheat flour and gluten to flour quality.

Here is an aerial view of the entire plant of Molinera Oriental S.A. at Santiago de Cuba, with its grain elevators, pier and ship unloading facilities. The plant was designed by Buhler Brothers, milling engineers of Uzwil, Switzerland. Combined pneumatic and mechanical equipment handles 100 tons hr. incoming grain. The capacity of the two-floor mill is rated at 1,600 cwt. flour, basis 24 hours, but officials report actual production is higher.

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Progress Report On Research Projects

JAMES W. PENCE
U.S. Department of Agriculture
Albany, Cal.

A major area of emphasis in the wheat research program at the western division is study of methods to improve freshness and palatability of baked foods at the time of purchase and consumption. Projects on bread flavor and freezing of bakery products fall into this category. Freezing by proper methods immediately after baking is the only known means whereby a substantial degree of the original quality of freshly baked products can be preserved for more than a few days. Where distribution and sale of strictly fresh merchandise are not possible, suitable freezing procedures can be used to provide merchandise of better eating quality than otherwise possible.

Research has shown that cakes generally are less sensitive than bread items to variations in freezing practices. Frozen cakes held for many weeks are still generally superior to cakes held for 24 hours at room temperature. In time, however, cakes deteriorate seriously in frozen storage. Best results are obtained when cakes are held in storage between 0° and —10° F. A cooperative study with the Agricultural Marketing Service and several private enterprises is being started to determine the most feasible application of freezing to various types of bakery operations from the standpoint of cost and possible economic advantage.

Other efforts to promote increased consumption of wheat foods include the development of quick-cooking traditional types of bulgur and canned, pre-cooked, whole grain bulgurs from soft white wheats. Besides these basic products, canned and ready-to-eat dishes, such as pilafs, poultry stuffings, cereal and meat combinations, etc., are promising possibilities.

Additional information has been obtained to support the postulate that sulfhydryl groups in flour proteins influence the mixing behavior of flours by means of a sulfhydryl-disulfide radical interchange mechanism. Flour fractionating and reconstitution experiments using sulfhydryl-blocking agents showed that the sulfhydryl groups in gluten, rather than those in other fractions, influence mixing characteristics. During the mixing of doughs, sulfhydryl-group contents fall rapidly during early stages but tend to level off at just below half of their original values as mixing is continued well into the breakdown phase.

After much unsuccessful effort with a wide variety of methods, separations of individual albumin protein components of flour are being achieved with ion-exchange cellulose derivatives. Amounts of purified components sufficient for baking and chemical characterization experiments are currently being accumulated. Methods using new extraction media and adsorption techniques are being developed for economical preparation of gliadin for commercial usage. Aqueous tertiary-butyl alcohol extraction followed by adsorption of impurities on carbon black produce gliadins of sufficient purity for commercial food and industrial use.

Early results from a comprehensive study of the relationship between acid-extractable pentosans of western white wheats and their milling quality suggest that high correlations, found earlier in limited comparisons, will be confirmed. More than 200 samples each of spring and winter wheats are being examined. Several hundred samples resulting from two crosses and subsequent back-crosses are being used to follow the heritability of factors affecting milling quality and pentosans content.

Chemical Compounds Associated with Aroma

IRVING R. HUNTER and
GEORGE O. KOHLER
U.S. Department of Agriculture
Albany, Cal.

The decrease in per capita consumption of wheat products, particularly bread, in recent years indicates, among other things, consumer dissatisfaction with flavor and palatability of bread sold today. Development of methods to improve flavor and quality of bread are worthy objectives of research and, logically, they must start with identification and measurement of the compounds responsible for this flavor.

Work has been initiated at the western division on the development and utilization of new methods, and modification of existing ones, for bread flavor work.

A study of flavor must progress through a certain number of definite stages before knowledge of the individual compounds involved can be obtained. These stages are collection, concentration, separation and identification.

Bread flavors were collected by condensation of volatile material distilled from bread during baking and

by adsorption on charcoal of material emanating from hot freshly baked bread.

Another method of collecting a sample of bread flavor was by means of extraction of bread with two types of solvents, (a) water and (b) methylene chloride. Both solvents have their advantages and disadvantages.

Other techniques used were steam-distillation of freshly baked bread and the preparation and study of a pre-ferment type brew in order to study compounds introduced to the dough by fermentation.

At the present time upwards of 30 different chemical compounds have been isolated from bread by workers at the western division and other laboratories over the country. Identity of some of these compounds is still indefinite, but most have been positively identified. Included in the group are compounds from the following types of compounds: Acids, alcohols, esters, and carbonyl compounds, such as aldehydes and ketones. Some are complex compounds such as keto acids, etc. Basic compounds, probably amines, have been shown to be present, but no individual compounds have yet been identified.

Little is yet known about the origin of these compounds, but it is known that both baking and fermentation are necessary for full flavor development in bread and, probably, both agencies contribute to the list of compounds thus far identified as contributing to bread flavor and aroma.

Survey of Literature On Wheat Conditioning

M. M. MacMASTERS
U.S. Department of Agriculture
Peoria, Ill.

The literature survey is being typed preparatory to review and publication. It will include about 750 references, some of which are duplicates from different journals. Taking duplications into account, there will be over 650 references.

The literature on wheat conditioning has been carefully surveyed for the years 1927 to 1957, inclusive. A few important references before and after this period have been included in the survey.

Summaries of all data found have been prepared under the classifications cold conditioning; warm conditioning; hot conditioning (at temperatures above 46° C.); steam conditioning; vacuum conditioning; conditioning by means of ultrasonic waves, high frequency current, electric condenser, and infrared rays; hygroscopicity of wheat; thermal properties of wheat; water absorption by wheat.

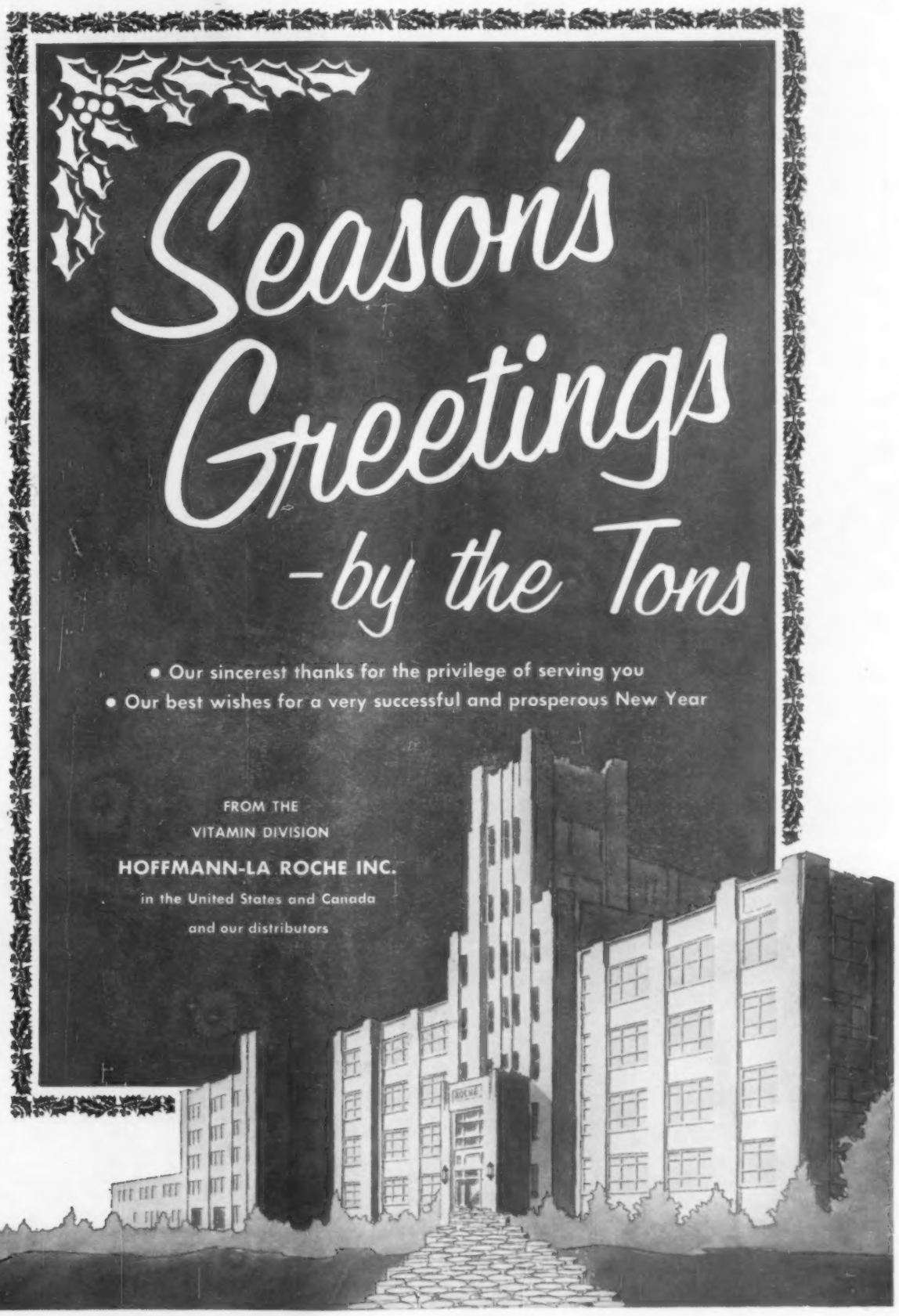
Data on cold conditioning indicate that the original moisture of the wheat and the relative humidity of the air, rather than the amount of water added, affect evaporation from the stock during milling. Increased moisture content of the stock leads to lower flour extraction and increase in production of bran upon experimental milling. It also has been reported to lower the resistance of kernels to crushing, to decrease scouring loss, to increase pearling loss, to decrease tempering time, and to effect a saving in power consumption. Cold conditioning of 48 hours has been recommended for Manitoba wheat, and conditioning for about 72 hours has been reported to permit obtaining the most break flour from hard wheat.

Warm conditioning usually was found to give results as good as or slightly better than those obtained by cold conditioning, as evaluated by cost, millability and quality of flour produced. Different wheats require different conditioning.

In general, the data on hot condi-

Curt Kenyon

MANAGER — Rex E. Yocum, Seedburo Equipment Co. president, has announced the appointment of Curt Kenyon as manager of Steinlite moisture sales tester. Mr. Kenyon was graduated from University of Illinois, an agronomy major, and has an MS degree in agricultural economics. He worked for the University of Illinois in its agricultural extension program in the soil survey department. For the past six years, Mr. Kenyon has been with the agricultural chemicals division of Dow Chemical Co.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tioning show that treatment of various kinds of wheat at over 46° C. brought about an improvement in yield and/or baking quality of the flour, but different lots of wheat required different conditioning. Improvement of both over-extensible and poorly extensible gluten has been reported to result from hot conditioning.

Steam conditioning of German domestic wheat resulted in better flour quality than was obtained when the wheat was unconditioned. Comparison of steam conditioning with normal and hot conditioning indicates that steam conditioning requires less power, often results in a higher yield of flour and of coarse bran and gives flour of as high or higher quality than is obtained after other types of conditioning. One investigator reported improved millability of hard red winter wheat after steam conditioning but found no improvement of baking quality.

All reported benefits should be viewed with reservations, since different workers have almost invariably used different wheats, different details of conditioning, and different methods of evaluating the results. The complete data should be carefully studied by experienced millers before conclusions are drawn.

Milling Quality Of Soft Wheats

M. M. MacMASTERS
U.S. Department of Agriculture
Peoria, Ill.
(Reporting work of R. S. Popham, Ohio State University)

Considerable progress has been made at the Ohio State University by Dr. R. A. Popham under contract from the northern division.

Studies have been made to determine if a rapid compression test might be developed to estimate milling quality of soft wheats. A motor-operated, unconfined compression machine was used to determine force required to barely crack individual kernels. Each test sample consisted of 50 kernels. Blackhawk, Wabash, Kawvale, American Banner, Trumbull, Thorne, Clarkan and Fairfield varieties of the 1955 crop and these varieties plus Butler and Lucas varieties of the 1956 and 1957 crops were tested.

Tests were made on undried kernels (as stored), and on kernels dried for one week at 55° C., for two weeks at 55° C., and for six hours at 100° C.

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Scenes at District 8, AOM, Meeting

Top, Willard Meinecke, General Mills, Inc., Buffalo, left, essay contest committee member, presents Eamon P. Ferguson, Maple Leaf Milling Co., Ltd., Toronto, with the contest $100 first prize. At right is Edward Mills, Maple Leaf, Toronto, third prize winner. Top center, Henry Dudek, Russell-Miller Milling Co., Buffalo, left, retiring district chairman, is presented with AOM distinguished service award by Donald S. Eber, Kansas City, AOM executive vice president. Bottom center, Mr. Meinecke presents Mr. Mills with his $25 prize. Bottom, Mr. Dudek is presented with an engraved gavel in recognition of his service to district by William Davis, Sterwin Chemicals, Inc., Buffalo. The meeting was held at Niagara Falls, Canada.

Drying for one week at 55° C. was concluded to be suitable. Kernels so dried gave compression test data that correlated as well as those from the two-week drying with Seeborg milling scores of the varieties. Drying for six hours at 100° C. led to poorer results.

The compression test values gave a more stable ranking of the varieties from year to year than was obtained from the Seeborg milling score. Clarkan variety gave no correlation between compression test value and Seeborg milling score. The other varieties showed correlation to 0.05 significance levels between the annual compression force data and the five-year mean Seeborg milling scores.

The effect of protein content on the compression force required to crack the kernels is now being investigated.

Another phase of the study is the investigation of stains and reagents that can be applied to the kernel tissues under the microscope to determine differences that may be correlated with milling quality. The following have been used, either alone or in combinations, often by various methods of application: Safranin, East Green, Anilin Blue, Chlorazol Black E, Bismarck Brown Y, Iodine Green, Methyl Violet Orange G, Acridine Red, Thionin and Phloroglucinol-HCl (cold). Several of the histochemical tests investigated showed either qualitative or quantitative differences when applied to Blackhawk (good milling), Trumbull (intermediate) and Fairfield (poor milling) varieties. Further work along these lines is contemplated. It is hoped that a quick field test for millability may be developed. Such a test would require only cutting the kernel open, applying the stain or reagent, allowing a short time for color development, and estimating milling quality from the result.

Wheat Gluten Analysis

R. W. JONES
U.S. Department of Agriculture
Peoria, Ill.

Previous attempts to determine the number of components in wheat gluten have met with little success. Perhaps the most definitive method of resolving such a problem is through the use of electrophoresis. In the case of wheat gluten special difficulties are encountered because of the insolubility of gluten in conventional electrophoretic buffers. Electrophoretic patterns of wheat gluten previously reported in the literature are asymmetric with respect to the ascending and descending boundaries.

The number of peaks in such patterns do not necessarily represent the number of components in the protein being studied. The primary objective of the present work was to find electrophoresis conditions which would give symmetrical diagrams. Such patterns would aid in establishing the number of components in gluten and their relative concentrations. An analytical tool also would be provided for following the progress of fractionation experiments. Lack of such a tool has been a handicap in previous attempts to fractionate gluten.

Several suitable buffer systems have been found. They include sodium chloroacetate-chloroacetic acid, sodium acetate-hydrochloric acid, sodium phosphate-phosphoric acid, all at pH 3.1 and nominal ionic strength of about 0.03, and aluminum lactate-lactic acid at pH 3.1 and nominal ionic strengths of 0.03 to 0.12. Electrophoretic patterns obtained in these buffers demonstrated that gluten of bread wheats is composed of at least four major and one minor component representing, in order of decreasing mobility, relative concentrations among themselves of approximately 44, 22, 15, 16, and 3%. There is evidence that the peak containing 15% of the total gluten is composed of two components. In addition, the patterns show the presence of a small amount of relatively fast-moving material which is believed to be globulin or albumin rather than true gluten protein.

While aluminum lactate-lactic acid buffer does not resolve the two faster moving components, the excellent symmetry of the patterns obtained in this medium at relatively high gluten concentration recommends its use for following the progress of fractionation experiments and for investigating the effect of such variables as gluten quality and method of preparation on gluten composition. A partial separation of the electrophoretic components has been obtained by precipitation of gluten from acid solution by increasing pH or ionic strength. The relationship between electrophoretic pattern and gluten quality and method of preparation have also been studied.

BARLEY MOVEMENT

WINNIPEG—Canadian barley exports climbed to 6,665,000 bu. in October to boost the aggregate for the initial three months of the 1958-59 crop year to 12,463,000 bu., compared with 13,906,000 for the same months of last year. The statistics branch of the Board of Grain Commissioners reports that the movement this year included 3,512,000 bu. to the U.S. compared with 8,428,000 a year ago. This year the big importer has been the U.K. with 7,755,000 bu. unloaded in the three months.

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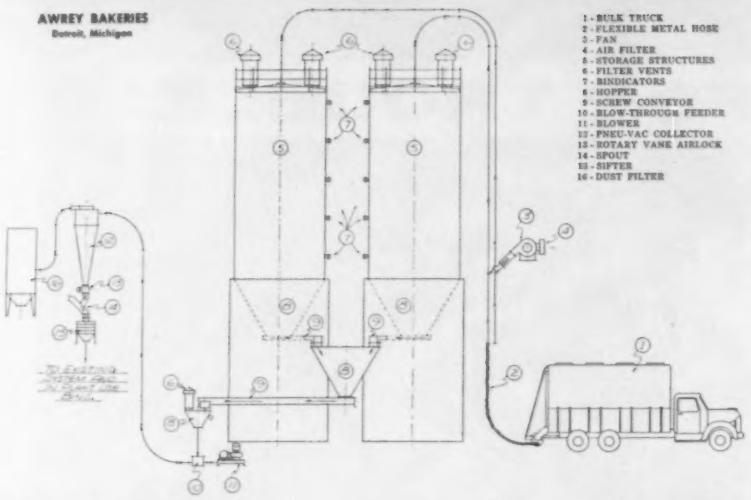


No. 2077—Bulk Flour System

Completion of a unique bulk flour system for receiving, storing and in-plant conveying at Awrey Bakeries, Inc., has been announced by Sprout, Waldron & Co., Inc. What makes this system different from most is the fact that Awrey is not located near any railroad siding and has to be completely serviced by means of bulk trucks, Sprout-Waldron explained. The bulk flour receiving system is designed for handling flour at 30,000 lb. hr. and conveying it to either of two Permaglas storage bins. A second pneumatic system conveys the flour at approximately 20,000 lb. hr. from the storage tanks to the bakery. Further details can be obtained by checking No. 2077 on the coupon.

No. 2078—Speed Reducer

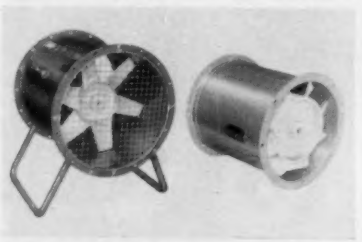
Introduction of the new Shaftex shaft-mounted speed reducer in sizes up to 40 h.p. and with nominal internal gear ratios of 5 to 1, 15 to 1, and 20 to 1 has been announced by Allis-Chalmers Manufacturing Co. A completely enclosed unit for direct mounting on the driven shaft, the Shaftex reducer is available in single and double reduction units. It can be adapted without disassembly to include back stops where reverse rotation is prohibited and overload releases for chokable conditions. The Shaftex reducer is usually driven by a fixed pitch diameter Texrope drive. Variable speeds can be obtained by using either stationary control or motion control Vari-Pitch sheaves. For a higher degree of positive ratio transmission, the Shaftex reducer can be operated with a Timetex timing belt drive. The Shaftex reducer's flexibility and simplicity result in substantial savings in space and weight. Construction and operating features of the Shaftex speed reducer are described in a new bulletin, copies of which are available by checking No. 2078 on the coupon.

No. 2079—Belting Bulletin

An illustrated four-page bulletin on the products of the Imperial Belting Co. is now available. The bulletin reports that all brands of Imperial belting are made of heavy-duty hard silver duck. This is a special, densely-woven, heavy fabric in which stretch is reduced to a minimum. The tensile strength of the belting is reported in excess of 750 lb. per inch of width. For more information check No. 2079 on the coupon.

No. 2076—Fans For Aeration

A new line of pressure type tubeaxial fans for grain aeration and crop drying has been developed by Propellair. The fans may be used for positive air moving in bins, dryers, or buildings. Designated as Propellair Type DT, the new fans are equipped with matched design motors and propellers, both of which are products of



the same manufacturer, resulting in competitive pricing and a single nameplate guarantee. They are available with propeller diameters of 8, 12, 16, 20 and 24-in. sizes; sizes through 60 in. are now under development. All propellers are cast of a spark-proof non-shattering magnesium-aluminum alloy and have the latest airfoil designs which provide maximum efficiency over the operating pressure range. Capacities currently range from 200 to 12,000 cu. ft. min. from free air to 5 in. static pressure. For more information check No. 2076 on the coupon and mail it to this publication.

No. 7218—Case Imprinter

A manually operated machine that imprints contents, brand and distributor or packer name and address on the ends of shipping containers has been announced by Rotary Imprinter, Inc. The carton printer can imprint copy legends up to 9 in. wide by 6 in. high, the company says. The machine, rubber type and liquid inks in any color are furnished by the firm. For further details, check No. 7218 on the coupon and mail to this publication.

No. 7221—Grain Conveyor Folder

A promotion folder, containing information about the Vac-U-Vator is available from Vac-U-Vator, Division of Dunbar Kapple, Inc. The folder discusses the Big Vac 980, with a new cleaner, which can load 1,200 to 1,500 bu. an hour, the company says. According to the folder, the unit will clean grain while it conveys, will turn and clean grain in flat storage or bins, will elevate up to 75 ft., can convey up to 400 ft. away and will do many other jobs. Check No. 7221 on coupon and mail for details.

No. 7216—Grain Fumigant Literature

The Dow Chemical Co. is offering literature on its new grain fumigant, Serafume. Included in the publications are brochures, illustrated posters, booklets and specification sheets. For more information, check No. 7216 on the coupon and mail to this publication.

No. 7142—Pneumatic Conveying Article

The availability of a four-page semi-technical article entitled, "Pneumatic Conveying Gives New Efficiencies," has been announced by Sprout, Waldron & Co., Inc. After listing the seven major advantages of pneumatic conveying, the article lists the items to be considered in determining whether or not a pneumatic system is economical for a given application. Bulletin F-27 is illustrated with photographs of positive, negative and combination pneumatic systems. A copy may be secured by checking No. 7142 on the coupon and mailing it to this publication.

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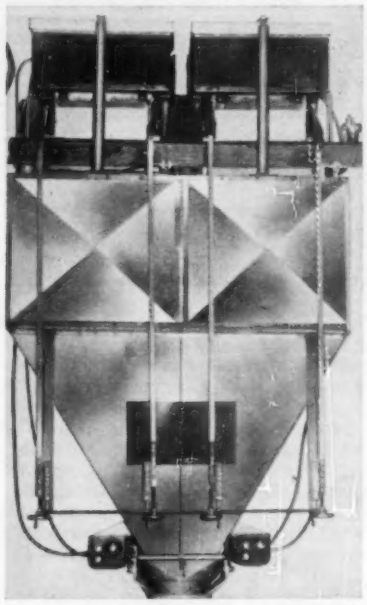
No. 7220—Packing Scale

A high speed packing (or bagging) scale has been announced by the Thayer Scale Corp. The model, 2N-18CC, is an automatic duplex filling unit consisting of two net weigher



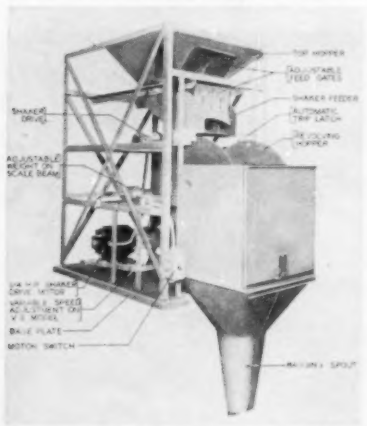
scales discharging into a common hopper. The company says the double feeder permits either single or dual operation, and the control panel gives the operator continual view of the scale's operational cycle. For more details, check No. 7220 and mail to this publication.

No. 7235—Grain Dockage Scale

A new scale has been developed by O. B. Armstrong to give a quick reading of the dockage percentage. Called the "Armstrong Percentage, Dockage and Computer Scale," the unit accommodates any sample from 250 to 500 grams and is designed for grain elevator operators, farmers and grain inspectors. Check No. 7235 on the coupon and mail it to secure details.

No. 7230—Weighing-Filling Machine

An automatic bench model weighing and filling machine has been announced by the Richardson Scale Co. The new unit, called the Holm model SS weighing and filling machine, provides 18 to 20 weighings per minute



of free, semi-free and non-free flowing materials, with maximum capacity of 12½ lb., the company said. The unit is designed as a bench or table model and consists of an angle iron frame, top feed hopper, motorized agitating feeder, feed regulator plate, revolving three-compartment weigh hopper, 1 to 3 or 1 to 4 ratio weigh beam carried on floating knife edge bearings, adjustable balance, discharge spout and a motor with an eccentric cam. Check No. 7230 on the coupon and mail for details.

No. 7146—Clean-Up Cart

The "janitorial" clean-up cart manufactured by the Screw Conveyor Corp. permits sweeping refuse or spillage directly into the cart—no shoveling is necessary. Featuring all-

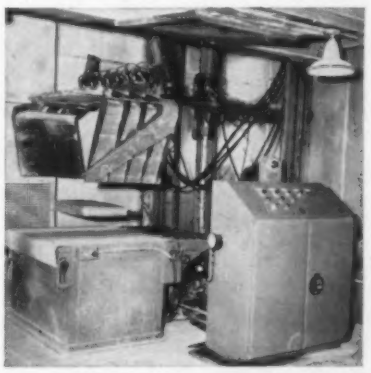
welded steel construction, the body of the cart measures 18x18x18 in. and is flared to facilitate loading and emptying. Other features include reinforcing ribs in sides and ball bearing wheels with rubber tires. Check No. 7146 on the coupon to get details.

No. 7263—Hammer Mill

The availability of a special hammer mill with a 26-in. rotor length has been announced by Sprout, Waldron & Co., Inc. According to the company, the design permits the continuous handling of sheeted rolls which are 24 in. in width. In addition to the wider feed throat and longer rotor, the mill is designed so that it can withstand 100% overload for varied lengths of time, the company said. Check No. 7263 on the coupon and mail to this publication for more details.

No. 7157—Bag Drop Tester

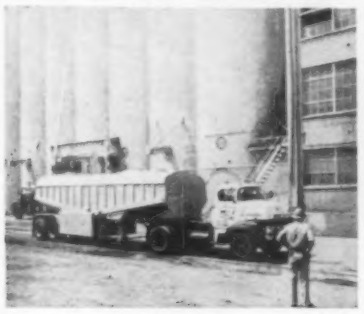
An automatic flat drop machine for testing filled multiwall bags has been developed by the St. Regis Pa-



per Co. Average rate of testing is two bag drops per minute, based on a series in which the height of each successive drop is increased in 6 in. increments from a minimum of 24 in. to a maximum of 10 ft. Once a bag has been placed on the machine, all handling is done mechanically until breakage is detected and the bag is taken off the machine by the operator. Only one operator is required. The tester is operated by setting the dials on a control panel to determine the height and pattern of drops in a test series. The number of drops made in a test series is indicated on the control panel. More information is available by checking No. 7157 on the coupon and milling to Milling Production.

No. 7141—Air-Slide Pump Trailer

A new design 35-ft. "Fruehauf Air-Slide" semi-trailer for bulk commodity transportation has been announced by the Fruehauf Trailer Co. Fast unloading speed by use of pressure



blowing is claimed. The trailer has a capacity of 800 cu. ft. Over-all height is 10 ft. 3 in. "Air-Slide" parts are produced by the Fuller Co. Check No. 7141 on the coupon and mail it to secure details.

No. 7151—Automatic Bag Printer

A new, automatic machine for implant printing of multiwall bags was recently announced by Industrial Marking Equipment Co. The unit feeds and prints up to 20 multiwall bags per minute. The feeding mechanism is operated by a vacuum pump and the magazine holds 250-300 bags

at one time. Inking is through felt rollers, internal ink reservoir and rubber transfer rollers. The unit can be produced to fit a single bag size, or made adjustable for moderate variation in bag sizes. Complete details are available by checking No. 7151 on the coupon and mailing it to this publication.

No. 7255—Ventilation System

An overspace ventilation system has been developed by the Rolfes Grain Aeration Companies to overcome the hazard of extreme heat in flat storage buildings during hot weather. The system employs a louvre that is installed beneath the roofline at one end of the building to let in outside air. A fan at the opposite end exhausts the heated dead air from inside and maintains constant circulation. For further details on the system, check No. 7255 on the coupon and mail to this publication.

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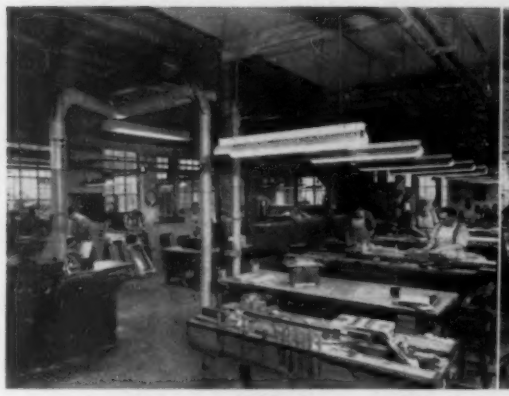
Assembly and Testing of Flour Milling Machinery



Part of pattern shop which serves foundry.

View of foundry. Sand reclamation at rear.

"Weathered" castings ready for machine shops.

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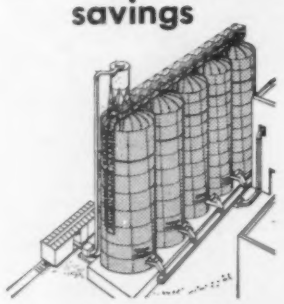

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EDITOR'S NOTE: Mechanical reliability has always been of vital importance to the miller, and never more so than today. Nowadays, there is an increasing tendency to run machines longer and faster than ever before. This practice means that machinery must be up to the highest of standards. When a miller is striving continually to increase output, he must be absolutely certain that his plant will stand any strain he may impose. Milling machinery manufacturing firms, among them Thomas Robinson & Son, Ltd., Rochdale, England, have geared themselves to provide the type of machinery that is demanded in today's milling operation. This is a report from Robinson on how it goes about manufacturing machinery that meets the standards of today.

TO insure that castings will possess all the qualities required of them, both in the subsequent machining processes and in many years of hard work in the milling industry, the work of the foundry is closely supervised by the staff of the metallurgical laboratory.

Samples of metal taken from the cupola furnaces during melting, and from the previous day's castings, undergo chemical analysis for carbon, sulphur, silicon, phosphorus and manganese content to insure their conformity to a standard specification. Similar tests are carried out to find the relative element ratios present in aluminium, phosphor bronze and other alloys used in the production of machine components.

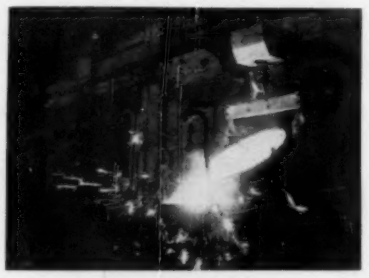
For close visual inspection of metals a powerful projection microscope which can enlarge up to 4,400 times is used. This is used to examine the actual metal structure, which directly controls the strength of metal. It also shows the distribution of phosphorus, and the matrix in which other elements are embedded.

The laboratory is fully equipped for mechanical testing and for close visual inspection of metal samples of all types. Tensile stress values are checked on a tensometer which records stress in tons per square inch. Tests of this nature determine the strength and quality of heavy duty cast iron which is used, for example, in helical gears for roller mills. These gears have to be immensely durable so that they remain accurately aligned and withstand a lengthy working life.

A metallurgist in the laboratories at Rochdale using a tensometer on which metal is tested to the point of destruction. The actual stress up to the point at which destruction takes place is recorded on the graph.

Testing Metal

The hardness of metal, which of course directly affects its resistance to wear over long periods of constant work, is mechanically gauged by a Firth Hardometer. Simply, this entails measuring an indentation imposed on the metal by a fixed load. For testing iron castings a steel ball is attached to the pressure head. For testing the wearing qualities of sheet steel, such as that used at Rochdale in the manufacture of ultra-indented cylinders, the steel ball is replaced by an industrial diamond.



Casting chilled iron rolls.

The chief metallurgical chemist is responsible for preparing and testing sand mixtures used in the molds from which components are cast. Because the finish of a casting can be made or marred by the composition of the molding sand, Robinson's have installed a Pneulec sand plant which deals automatically with the work of recovery and conditioning.

Push button controlled from a central control panel, the Pneulec plant recovers and cleans sand used in previous castings and mixes it with new sand, water and binding materials including coal dust and bentonite. The various stages of this process are automatically run in rotation to prevent power overloading. Ninety-five percent of the sand is reclaimed.

Molds and Cores

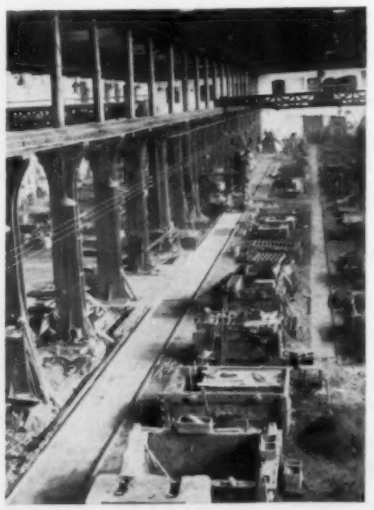
To obtain a smooth, even casting the efficient ramming of molds is vital. When tackled by hand the job requires the service of a highly skilled molder and output is limited. To increase production Robinson's have installed two machines known as sand slingers. One slinger travels on rails down the length of the molding bay and can fill and ram a box evenly and tightly at a speed only limited by the rate at which it can be fed.

Wooden patterns, which are made individually in the pattern shop adjoining the foundry, are withdrawn after the molding box has been rammed, the withdrawal being carried out on a mechanical turnover machine. The pattern is vibrated while the mold is being slowly withdrawn on a hydraulic ram. Molds are then placed on the floor, cored-up, closed and made ready for casting.

Cores are hand-made in another section. Medium grade washed silica sand, a proprietary brand of core oil and binding materials are combined to give a specified degree of bond. Special core sand mixes are prepared for smaller castings such as parting brackets in roller mills. The formula, which includes a finer grade of sand and a higher ratio of oil, is carefully chosen to produce the flawless core finish so necessary to the precision casting of small components for flour milling machines, Robinson officials said.

Three cupolas, each with a capacity for melting 6 tons 1 hr., are used on alternate days to supply the foundry with molten metal at a temperature of 1,450 to 1,500° F. When large castings up to 7 tons are being made, two furnaces are run together. Special irons including nickel, chrome and molybdenum additions are melted in a smaller furnace. Ni-hard and alloyed high duty iron with a tensile strength of up to 25 tons sq. in. is also melted in this furnace.

Ladles ranging in capacity from 10



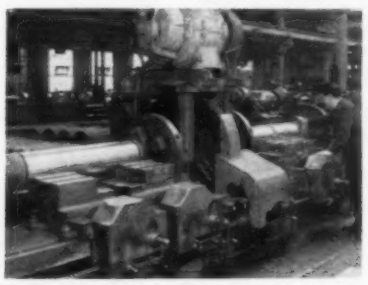
The general view of the Rochdale foundry. Sand reclamation grids can be seen in the center trackway down which a sand slinger travels.

An inspector using Solex gauging equipment in the main inspection department.

cwt. to 5 tons are separately conveyed as required to the pouring station by one of the four 10-ton overhead cranes, which perform all the heavy lifting operations throughout the foundry.

Robinson's have cast chilled iron rolls for the milling industry for more than half a century, and various sizes of rolls are produced on a regular production basis by a highly specialized plant. A refined hematite iron with a low silicon content of approximately 6% is used in order to obtain a chill depth of at least ¾ in. for surface hardness of 500-520 Brinell.

A non-ferrous department produces approximately 5% of all castings. Many important component parts for milling machinery are cast here in-



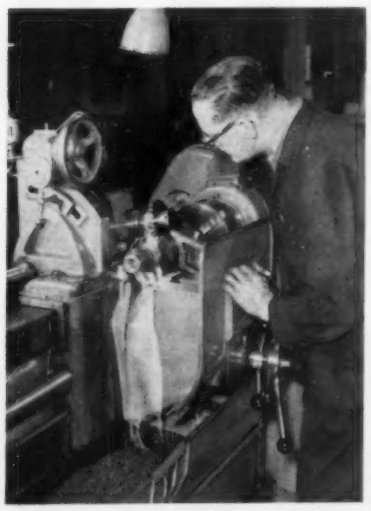
Roll castings being turned on a double stab-turning machine.

cluding the phosphor-bronze bearings which enable the roller mills to work at consistently high speeds on large capacities. Other components are cast in aluminium, brass and phosphor-bronze; melting is in two pit furnaces and two gas fired furnaces run at lower temperatures than those required for ferrous metals.

The Machine Shop

Producing milling machinery is a very specialized type of engineering and as such demands specialist techniques. Many of the machine tools used have been designed and produced by the company.

Examples of special machine tools

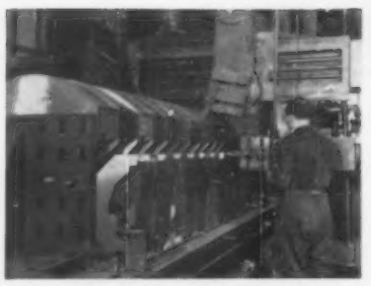


The Cornelis worm and screw thread generating machine, one of the first reportedly to be introduced into England.

can be seen in the roller mill machine shops, Robinson officials pointed out. Rolls are stab-turned, bored, shafted, ground and corrugated on equipment designed and made at Rochdale. A double stab-turning machine reduces the diameter of roll castings by 0.005 in. each revolution. Both ends of the roll are bored simultaneously. The half shafts are then forced into position under a pressure of 37 tons and then rough turned. The spindle ends are then ground on centers, before the roll body is finally ground to fine limits from the shaft bearings themselves, thus ensuring absolute concentricity.

In the heavy machine shop, machine tools are arranged in banks, to facilitate continuous batch production. Some of the larger castings go first of all to great double column planing machines. The largest is capable of handling a casting 6 ft. wide by 6 ft. under the beam by 14 ft. long, and will handle 15 roller mill ends at one time.

Innovations in milling machinery always demand new machine tools if a high standard of work is to be



Planing a batch of rollermill end frames on a Butler planer.

TECHNOLOGISTS SEE NEED FOR FORTIFICATION OF FOODS SUCH AS BREAD AND PROCESSED CEREALS WITH VITAMIN B_6

While a "minimum daily requirement" has not yet been established for Vitamin B_6, the most recent data suggest the human need for this nutrient may be even greater than for thiamine and riboflavin. A composite of recent studies indicates that as much as 2-7 mg. of B_6 may be desirable in the daily diet.

Although Vitamin B_6 is widely distributed in foods, a large portion appears to be lost or destroyed during processing or cooking. One study contrasting the B_6 content of wheat fractions shows that while whole wheat flour contains approximately 2.09 mg./lb. of B_6, patent flour contains only 0.99 mg./lb.—a loss of 50% B_6 content through processing. Almost all white breads on the market today contain only 0.45 mg. of B_6 per one pound loaf. When you add to this the fact that meat in cooking has been found to lose as much as 57% of its B_6 content and that canning and processing of foods markedly reduces their natural B_6 content, you can see evidence of a marginal B_6 intake in the diet today.

There would appear to be good reason for food processors to consider fortifying their products with Vitamin B_6.

If you would like further information on this subject, write Pfizer for a copy of Technical Bulletin 96 and "*VITAMIN B_6—The Case for Dietary Enrichment.*"

* * *

New Facts About Lysine Supplemented Bread

The quality and efficiency of wheat protein can be markedly improved by supplementation with the essential amino acid, L-Lysine. (Pfizer produces L-Lysine by a unique fermentation process assuring highest quality.)

A recent nutritional report compared the protein quality and quantity of white bread, protein bread and egg. It shows that nine slices of ordinary white bread are required to equal one egg in terms of quality and quantity of protein. If white bread is supplemented with lysine, only five slices equal one egg.

The report shows that protein breads can be improved in a similar manner. If protein bread is supplemented with lysine, three and one half slices instead of five provide the same protein quantity and quality as one egg.

If you would like further information on lysine supplementation of bread and other products such as breakfast cereals, write to Pfizer for Technical Bulletin 89, "*L-Lysine Monohydrochloride.*"

* * *

New BI-CAP® Enrichment Concentrate For Cornmeal

PFIZER BI-CAP® was one of the first enrichment concentrates. And this "head start" in vitamins has continued. It means that Pfizer can help you with the newest developments in enrichment products.

PFIZER BI-CAP has recently been improved through vitamin research. It is now a lighter colored enrichment mixture with an even riboflavin dispersion that overcomes unsightly agglomeration.

A new addition to the BI-CAP enrichment line is BI-CAP Bolted Cornmeal Enrichment. Pfizer also continues to offer its BI-CAP Degerminated Cornmeal Enrichment plus both single and double strength flour enrichment mixtures. If you would like further information write **CHAS. PFIZER & CO., INC., Chemical Sales Division, 630 Flushing Avenue, Brooklyn 6, New York. Branch Offices: Chicago, Ill.; San Francisco, Calif.; Vernon, Calif.; Atlanta, Ga.; Dallas, Texas**

A small parts inspection bay.

Section of the sifter production floor

Sifters being assembled for running tests.

maintained, Robinson officials said. Many of the machine tools in the shop have been installed within the last few years. Very recent additions include an Asquith 8 ft. radial arm drill, a Robinson-designed feed roll corrugating machine and a large Lumsden surface grinder, the latter being used on components such as removable curved front ends of roller mills, which are held in position by a magnet table and machined to fine limits by grinding wheels up to 24 in. in diameter.

The firm also has a Cornelis worm and screw thread generating machine —a rarity in England, according to Robinson officials. Here the thread is generated while the spindle is at right angles to the axis of the thread being cut. The normal practice is to cut square thread by either single point tool or screw miller. The new machine produces at a greater speed which results in economic production while maintaining a high standard of quality, Robinson officials declared.

Close by is a Cri-Dan threading machine which sets and cuts to depth automatically. This has two big advantages over older methods for, in addition to speeding up the work, the automatic setting is a guarantee of consistent accuracy, the firm reported. It takes less than 30 seconds for the operator to insert a component such as a roller mill bearing plug, machine this and release it on the Cri-Dan. The actual threading operation is carried out in less than 15 seconds.

Quality Control

Interchangeable parts are desirable with any form of machinery, and a milling plant is no exception. This interchangeability is insured at Robinson's by exercising a considerable degree of quality control, the firm said. Parts are machined in batches, to give similarity of treatment, and throughout all operations a very high standard of inspection is maintained to insure that all are within the limits of size demanded.

One example of this is seen in the bay where small components are turned, officials pointed out. Amongst the lines of semi-automatic turret lathes is a cylindrical grinding machine. This machine is fitted with Solex gauging equipment which sizes jobs while in the machine to tolerances of 0.0003 in. To insure complete accuracy, this method of determining fine limits is used again during inspection.

Quality control is again brought into sharp focus in the small parts inspection bays, where many hundreds of components are checked against relevant comparators and master gauges. The Parkson gear tester, for example, determines that roller mill gears have been cut correctly so that they will run at the exact center distance required.

Every machining section has its own inspector, who is responsible for seeing that the first component of every batch is correct, before allowing the operator to proceed with the remainder of the batch. This method of inspection cuts out wastage, but a complete batch must still be passed by the main inspection department before passing to the assembly bays.

Production Control

Producing milling machinery is a highly complex operation, Robinson officials noted, calling for comp'ete coordination between every part of the production system. Every part of the manufacturing process must be carefully scheduled to insure that delivery dates are strictly adhered to, and coordination to achieve this is managed by a control room. Here the diverse activities of the works can be seen in perspective, and everything is kept in line with the general pattern. Orders for the individual components are issued to the machine shops for the commencement of each operation in strict accordance with delivery dates. In addition, detailed operational charts are compiled which show at a glance the progress of every order.

The work of the main production groups is broken down into some 70 subdivisions, controlling the activities of different types of machinery. Foremen and workmen are in contact with control throughout the working day, and there is a constant flow of completed work cards back to the control department.

Milling machinery must be assembled by skilled labor. At the same time, with exacting delivery dates to keep, it must be assembled with the utmost speed. An additional complicating factor is the wide variation in the types and sizes of plant to be assembled. Fitters at Rochdale work under supervision to a strict schedule of batch erection. In this way output is kept at a high level, without any diminution in standards, Robinson officials said. As a final touchstone of consistent quality each machine undergoes a prolonged running test.

By following the assembly of a roller mill it is possible to gain a comprehensive picture of Robinson methods, the officials said.

Assembling a Roller Mill

The modern roller mill is complex, and its assembly is no simple process. Everything has to be carefully organized on scientific lines: components must be meticulously calibrated to insure accuracy in the completed machine. Small parts are measured and matched in the subassembly bay, where all the small components for roller mills are

A batch of roller mills being assembled on the roller mill production floor.

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Listening for vibrations which indicate smooth running and correct lubrication of a roller mill.

brought together. Here hundreds of parts are stored in sliding racks.

The first stage of erection is the putting together of the base and two sides of the roller mill. The skeleton is then given its wooden lining, and a coat of primer applied to prevent sweating. Next, the internal components are bolted into position. This is perhaps the most important stage in assembly and great care is exercised throughout, Robinson officials said. One of the features of the assembly bay is the five-ton crane which is continually at work above the heads of the fitters. The crane is employed in conveying parts to various points on the assembly floor from storage lines running the length of the workshop.

Testing Is Vital

Before the roller mill is fitted with final details it undergoes a strenuous

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* U.S. PATENT No. 2,606,857

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The N. P. Bowsher Co., South Bend, Ind.

series of tests and inspections. Gauges are used to check that all parts conform to specification; running tests are long and exacting. If a machine gives a less than faultless performance it is stripped, adjustments are made and tests repeated. Lubrication systems are subjected to periodic heat tests, because correct working temperatures are a guarantee of the close-running fit essential to efficiency.

One of the processes in the testing procedure involves the use of a stethoscope. When rolls are "tramelled" for alignment, an inspector listens for the vibrations which indicate smooth running and correct lubrication. Inspection and test is followed by the fitting of doors and other external features. The completed machine is then conveyed on a miniature railway line into the paint spraying shop. Here it is given the final touches to complete the careful process which is the making of a perfect roller mill.

Range of Machines

Erection procedure differs according to a type of plant concerned. The plansifter has a central fabricated frame bolted-up and welded with appropriate supporting metalwork. A closer look at this unit shows that the main bearing housing is fitted into a welded and stretched center plate into which an eccentric shaft is lowered. Timber sieve boxes, manufactured in Robinson's own sawmill and jointers' shop, are carefully and snugly fitted into the frame before the entire unit is bolted together. The plansifter is tested under running conditions for concentricity at various eccentric settings.

Sides and tie rails on the heavy cast iron base of the purifier arrive at the assembly bay after being machined on a plano-miller to fine limits. The upper frame is a fabricated unit with cast aluminum ends machined for the reception of longitudinal extruded sections which create a frame to accommodate chambers and external windows for exhaust trunking. Sheet aluminum hoppers are connected to ground shafts carrying eccentric sleeves which require skillful fitting because of the close accuracy of the relative angular setting. Upper sieve frames of the purifier are fabricated from sheet aluminum and extruded sections suspended and coupled to an eccentric shaft. Since the machine's mechanical efficiency depends on the exactitude of their setting, each individual cam is checked to insure accuracy to a limit of 0.003 in. on angular displacement.

In keeping with standard test practice, the plansifter and purifier undergo a running test during which correct motion and balance are among the points inspected. The main assembly shop is served by a giant three-story spare parts store used in sub-assembly and for after-sales service. Many types of machine take shape here and wherever possible erection is in batches.

Checking cams on purifier eccentric shafts to insure accuracy to 0.003 of an inch.

Separators, cyclones, chain and worm conveyors, metal elevators and trunking, etc., are built in the well-equipped sheet-metal department occupying three floors. Apart from a standard range of machinery for cutting, rolling and shaping metal, Robinson's have installed a number of special units. The most versatile of these is a Herbert Pullomax P5, capable of carrying out dozens of operations, including nibbling, doming, edging and the cutting of slots, circles and louvres.

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RESPIRATOR

(Continued from page 3a)

condition of grain fever, but oats and rye affected some people handling grain more than wheat.

A sample of the screenings dust was forwarded to the U.S. Department of Agriculture to find out the probable cause of the eye irritation. Microscopical examination showed that the dust consisted in large part of hairs from the cereal hulls.

Dr. Rutherford T. Johnstone, a foremost expert on occupational diseases, stresses the necessity of proper ventilation to avoid damage from grain dust and mill dust. There should be rigid adherence to proper ventilation, he points out, and inspection of the hazard should be periodic to insure the minimal concentration of dust.

Protection of Fumigators

Troubles of the respiratory organs in the milling and grain industry are mostly of the lighter kind. Dr. D. Gordon in Australia though recently reported three cases of acute carbon bisulphide poisoning of workmen whose job it was to fumigate 12,000 bags grain in a sealed building. In all, 40 gallons of carbon bisulphide were used. Unfortunately, owing to ignorance of the nature of the fumigant, the three men entered the sealed room and emptied out each drum by hand. The first man, who was working on the floor, was overcome by the heavy fumes and died. The other two men, who had been working on top of the grain stacks, both collapsed.

One of them remained in a hospital for 24 hours only with no lasting ill effects. The other man was unconscious when he was admitted to the hospital. He stayed in the hospital three weeks to allow healing of the burns which he had received from an explosion. Dr. Gordon emphasizes that it is highly dangerous for grain fumigators to enter a fumigation chamber to empty the carbon bisulphide containers. This is usually done by first sealing the chamber and then pouring the fumigant in from the outside through "earthed" pipes especially placed for this purpose.

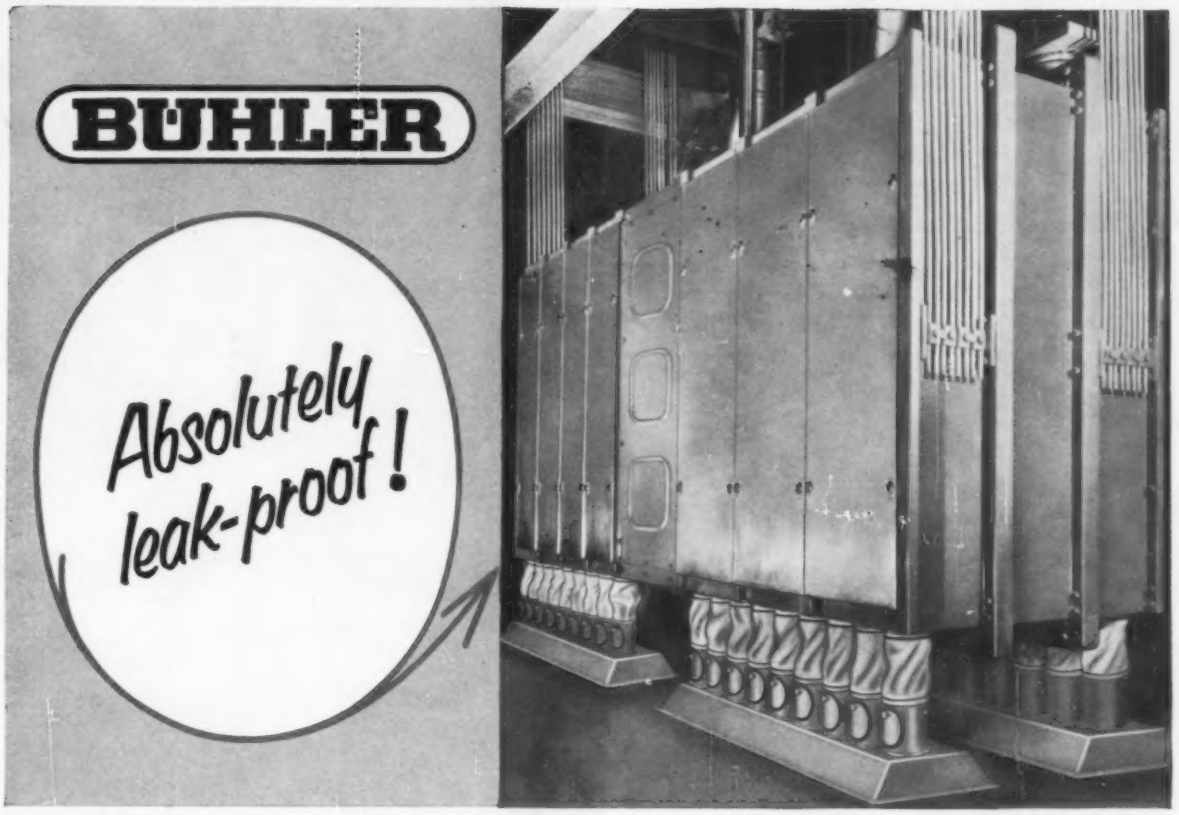
—BREAD IS THE STAFF OF LIFE—

LAKE SHIPMENTS GAIN

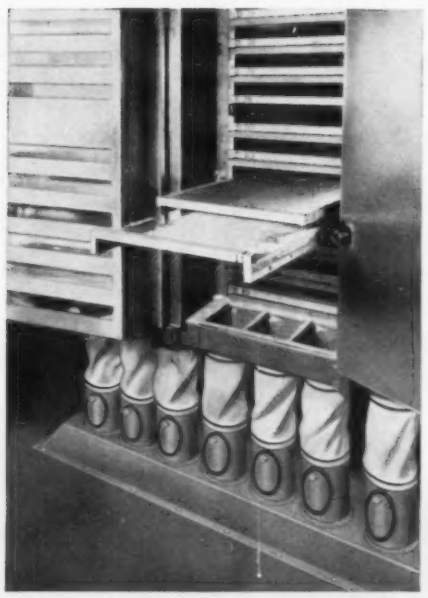
BUFFALO, N.Y.—Grain shipments on the Great Lakes during October recorded gains from 1957 levels. October grain shipments totaled 1,406,339 net tons, compared with 1,267,553 in October, 1957, the Lake Carriers Assn. has reported. Grain shipments for the year to Nov. 1 were 9,501,943 net tons, compared with 11,291,655 in the same 1957 period, the association reported.

RESEARCH ON GRAIN STORAGE PUBLISHED

WASHINGTON—How much grain to store or to release in any given year in order to realize maximum public benefit is subjected to economic analysis in a basic research study published Oct. 24 by the U.S. Department of Agriculture. The technical bulletin, entitled "Carryover Levels for Grains—A Method for Determining Amounts that Are Optimal Under Specified Conditions," was written under contract for USDA by Robert L. Gustafson, assistant professor of economics, University of Chicago. Single copies of the study (TB-1178) may be obtained from the Office of Information, U.S. Department of Agriculture, Washington 25, D.C. Additional copies are available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.



The BUHLER PLAN-O-STAR... New high-capacity drawer type sifter



Sieves and trays may be removed individually from either side of the Sifter.

Planning to modernize?

Then it will pay you to take a close look at this new metal Sifter . . . and consider the many operational advantages you'll gain by doing it the BUHLER way. For example:

High Capacity. In capacity per sq. ft. of bolting area, the new BUHLER *Plan-o-Star* is surpassed by none . . . and at the same time, requires a minimum of floor space.

Sieves Removed Individually. It takes one man only a few seconds to remove the handy size sieves for inspection, cleaning, or interchange at any point of a sieve stack. Each compartment can be opened from both sides in a matter of seconds. Sieves and trays are separate and of standard size. No conveying flights. Sieve cleaning method is optional; either cotton cleaners or brushes.

Leak Proof. Tight-fitting labyrinth joints make the *Plan-o-Star* completely leak-proof, inside and out.

Individual Drive. The BUHLER *Plan-o-Star* is usually driven by a vertical flange motor with V-belts. Simple operation, low power requirements.

Easy to Clean . . . therefore, the highest degree of sanitation.

Other Features. Sifter flow is easy to change . . . adaptable stroke for high or low speed sifting . . . strong supporting frame.

Write today for more information on this unusual new Sifter. You'll be under no obligation.

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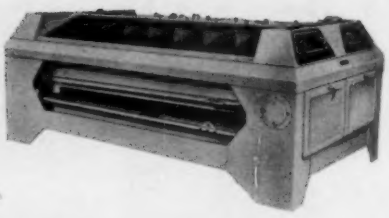

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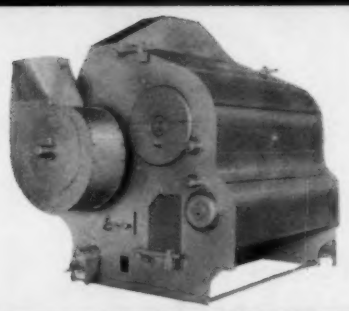

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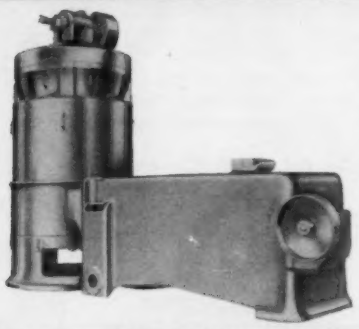

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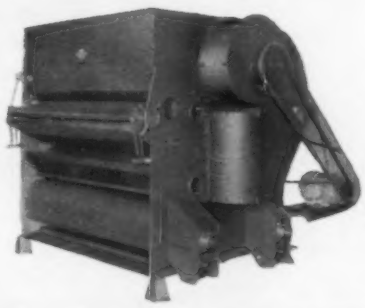

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